भारतीय मानक
Indian Standard

IS 9303 : 2021

टेबल अंगूर के शीत भंडारण के लिए मार्गदर्शिका

(पहला पुनरीक्षण)

Guide for Cold Storage of Table Grapes

(First Revision)

ICS 67.080.10

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November 2021 **Price Group 4**

Fruits, Vegetables and Allied Products Sectional Committee, FAD 10

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Fruits, Vegetables and Allied Products Sectional Committee had been approved by the Food and Agriculture Division Council.

To ensure fuller utilization of perishable foodstuffs such as fruits and vegetables, they should be preserved under conditions which will keep them fit for fresh consumption over a reasonable period. Storing them in refrigerated space (cold storage) is an important method of preservation. To provide guidelines for the cold storage industry in the country, a series of Indian Standard guides have been issued. These guides describe the pre-storage treatments and the optimum storage conditions for different fruits and vegetables to help the industry to develop on scientific lines and also to promote the export of fresh fruits and vegetables.

This standard was first published in 1979, for which assistance had been drawn from the then ISO Draft International Standard on the subject. The first revision of this standard is being brought out to align the conditions of storage with those prevailing in Indian scenario. Considerable assistance has been derived from the work carried out at the CSIR-Central Food Technological Research Institute, Mysore and ICAR-Indian Institute of Horticultural Research, Bengaluru.

This Indian Standard provides guidance on storage of table grapes, however, because of the variability of the product according to the time and place of cultivation, local conditions may make it necessary to define other conditions for harvesting or other physical conditions in the store.

The application of the guidelines contained in this Indian Standard should enable much wastage in storage to be avoided and thus should enable long-term storage to be achieved in most cases.

The composition of the Committee responsible for the formulation of this standard is given at Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

GUIDE FOR COLD STORAGE OF TABLE GRAPES

(First Revision)

1 SCOPE

This guide gives conditions for obtaining prolonged storage of different varieties of table grapes (*Vitis vinifera*).

2 TERMINOLOGY

2.1 Gray — Gray (Gy) is the unit of absorbed radiation dose. 1 Gy is equal to 1 Joule of energy/kg of material being irradiated.

2.2 D min — It is the minimum absorbed dose received by the food samples when subjected to radiation treatment.

3 CONDITIONS OF HARVESTING AND COLD STORAGE

3.1 Varieties

The commercially cultivated grape varieties in India include. Thompson seedless, Anab-e-shahi, Dilkush, Bangalore blue, Gulabi, Perlette, Flame seedless, Sharad seedless, Crimson seedless, Red globe, etc.

3.2 Harvesting

3.2.1 *Maturity*

Grapes are non-climacteric fruits that do not ripe after harvest and are picked from the vine at the fully mature and ripe stage. Table grapes should be harvested at right maturity stage to have the optimum eating quality and to enable them to withstand the vagaries of handling and transport. The maturity can be judged based on the following:

a) Appearance of characteristic colour of the cultivar and waxy bloom on the surface of the berries. On ripening, grapes which are green in colour at immature stage turn to amber colour (in case of white varieties) or attain uniform dark colour (in case of colour varieties characteristic to that variety) (Fig. 1). Further the seeds of ripe berries become dark brown.

b) Easy separation of berries from the bunches.

c) Characteristic aroma and flavour.

d) Total soluble solids (°Brix)

  a) Anab-e-shahi and its mutant Dilkush : 14-16 percent
  b) Bangalore blue :16-18 percent
  c) Gulabi :18-20 percent
  d) Perlette :16-18 percent
  e) Thompson seedless andits clones (Sonaka and T as - A. Ganesh) : 20-22 percent
  f) Flame seedless : 18 percent
  g) Sharad seedless : 20-22 percent
  h) Red globe : 20-22 percent
  j) Crimson Seedless : 18-20 percent

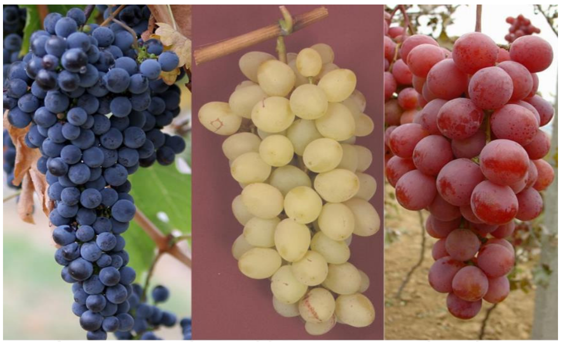

FIG. 1 APPEARANCE OF WAXY BLOOM ON MATURE BUNCHES

3.2.2 *Method of Harvesting and Handling*

Grape bunches should be clipped with scissors carefully without injuring the berries. Clip the bunch above the knot present on the bunch peduncle which helps in retention of freshness by reducing the loss of moisture. Harvesting should be done during the cooler part of the day loss of moisture and pedicel desiccation. The harvested bunches should be placed carefully in clean containers, preferably plastic crates, with proper cushioning material at the bottom and placed under the shade of the vine till they are transported to pack-house. Rough handling results in loss of natural bloom (thin wax coating on berry surface) making the berries susceptible to moisture loss.

3.3 Pre-storage Operations of Trimming and Sorting

Trimming of bunches is done with scissors to remove the undersized, immature, dried, split and damaged berries. Sort out and discard the diseased and rotten bunches if not removed during harvesting. Handling bunches carefully at all time to avoid removal of the waxy bloom and berry damage is highly essential. Rubber gloves should be worn while sorting or trimming operations and handling of bunches.

Grapes should not be washed before storing as it would be difficult to remove the wash water completely and may lead to enhanced spoilage.

3.4 Storage

3.4.1 *Quality Characteristics for Storage*

Only sound bunches with green stalk and turgid berries that are free from any visible signs of spoilage should be kept for storage. The amount of water content is more in immature berries (as the sugar content is low) compared to fully mature berries. Berries with high water content are more prone to withering even with slight fluctuations in the storage temperature and humidity during storage. The water loss from immature fruits is also rapid and immature berries shrivel faster than fully mature berries. So avoid storing immature grape bunches.

3.4.2 *Packaging*: The grape bunches should be packed properly before putting into storage rooms. Grapes meant for cold storage of export should not packed in traditional bamboo baskets and wooden boxes. Corrugated fiberboard (CFB) boxes are most suitable for packing of grapes. Generally 4-5 kg capacity ventilated CFB boxes having a maximum size of 50 × 24 × 13 cm are used for packaging of grapes. A layer of bubble pad or paper shreds can be placed as cushioning at the bottom of the box and a polythene lining of 100 gauge thickness is placed over this. Uniform bunches of 300 to 600 g each are packed in perforated individual plastic pouches with the stalk ends up, to avoid chances of bruising of berries and these pouches are placed inside the polythene lining. The grapes are then precooled and the sulphur pads are placed over the grapes. The sulphur pad is separated from the grapes by layers of tissue paper. This is then covered with the polythene lining.

Care should be taken not to erase the bloom of berries while weighing the bunches and use of hand gloves is must while handling the bunches during packaging. While packing, the grapes should be neither compressed nor loose so as to cause rubbing of berries against the wall of the box or against each other leading to loss of natural bloom. It is recommended that the bunches be packed in a single layer. The contents of each package should be uniform, in order to facilitate checking during storage. The bunches should not be packed together too tightly in the packages.

3.4.3 *Grape Guard/Sulphur Pads*

Sulphur pad commonly known as ‘grape guard’ is a brown sheet containing sodium metabisulphite (SMS) (Fig. 2). Quick release (QR) pads coated with a layer of SMS on one side of the brown paper could be used for short term storage (2-3 weeks) of grapes. The slow release pads (SR) with a layer of SMS coating and small white pouches with granules of SMS packed in it can be used for long term storage (10-12 weeks) (Fig. 3). Sulphur dioxide is released slowly in the moist atmosphere of the package creating SO_2 atmosphere around the bunches. This gas will retard the growth of moulds and also retain the green colour of the bunches (Fig. 4). The high humidity maintained inside the PE lining helps in preventing stem drying and thus berry shattering. For coloured grapes, quick releasing sulphur pads and high storage temperature should be avoided as high SO_2 released may bleach the colour of the grapes.

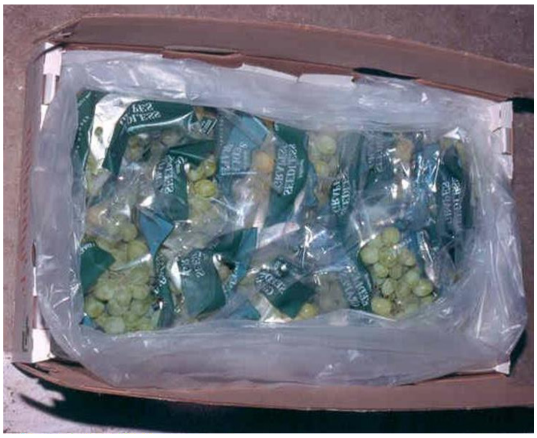

FIG. 2 PACKAGING OF GRAPES WITH GRAPE GUARD

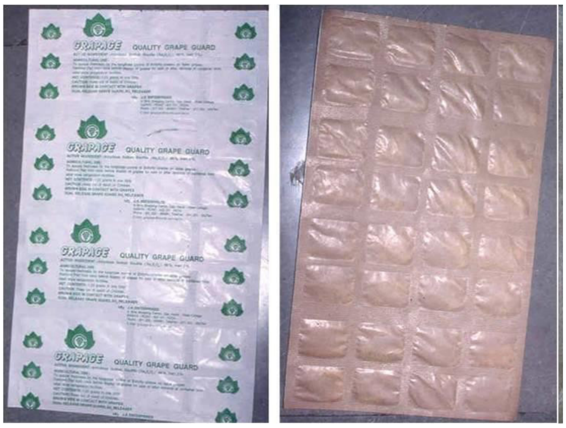

FIG. 3–SLOW RELEASE GRAPE GUARD (FRONT AND BACK VIEWS)

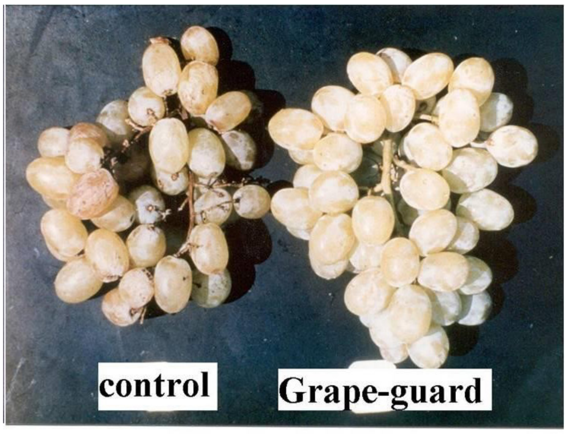

FIG. 4 CONTROL OF SPOILAGE USING GRAPE GUARD

The CFB boxes used for packaging should have a waxed inner surface to minimize the absorption of moisture from the grapes when the grapes are packed as such for the local market (without using the grape-guard or PE lining). Further, use of bubble sheet as cushioning material instead of paper shreds will prevent the loss of moisture from berries to paper shreds, especially when bunches are not packed in individual polyethylene pouches. The usual practice of packing of bunches in perforated individual plastic pouches and placing these pouches inside the polythene lining will help in maintenance of humidity inside the pack and reduces moisture loss to a great extent.

3.4.4 *Precooling*

The postharvest management of grapes relies heavily on achieving the optimum temperature of storage as soon as possible after harvest. Pre-cooling is very important in grapes as the difference between field heat and storage temperature of 0-1 °C is very high. Pre- cooling is usually done by using forced air cooling method. For maintaining the quality of fresh grapes, the fruit tissue temperature should be rapidly precooled to 1-2 °C within 6-8 h for harvest. Precooling is effective in minimizing moisture loss and improves the shelf life of grapes. Introducing Sulphur pads immediately after precooling avoids SO_2 injury as the rate of SO_2 release is controlled much more effectively at this temperature. Precooling can be carried out in mobile precoolers on the way to cold storage or in precooling chambers at pack houses (Fig. 5).

Following should be taken care of:

a) Pre-cooling must start as soon as possible after harvest;

b) High humidity of 90 to 95 percent should be maintained in the forced air precoolers as low humid air passing over the produce at higher speeds would result in greater moisture loss; and

c) Grapes precooled by forced air cooling method at 0 °C with relation humidity of 90-95 percent would take normally 6 to 8 h to pull down the berry temperature from around 30 °C to 1 °C.

3.4.5 *Irradiation*

Gamma radiation treatment (D min 0.4 kGy) of grapes is recommended as a phytosanitary measure to overcome technical barrier to trade. The radiation dose used are within the window of approved dose range for Fresh Fruits and Vegetables (Class 2) as per the Food Safety and Standards Rules and Regulations.

3.4.6 *Optimum Storage Conditions*

The precooled grape boxes should be stored immediately at 0-1 °C. Grapes should always be stored at optimum relative humidity in addition to the optimum storage temperature especially where PE lining of boxes is not done. A relative humidity of 90-95 percent is recommended for grapes. The boxes should be properly stacked by pelletization (Fig. 6). Enough air movement should be provided to remove respiratory heat and maintain uniform temperatures during cold storage. Temperature more than 0-1 °C and or humidity less than 90 percent leads to more moisture loss from berries. Care should also to be taken that the storage temperature should not go much below zero degree centigrade that may freeze the grapes and cause freezing injury.

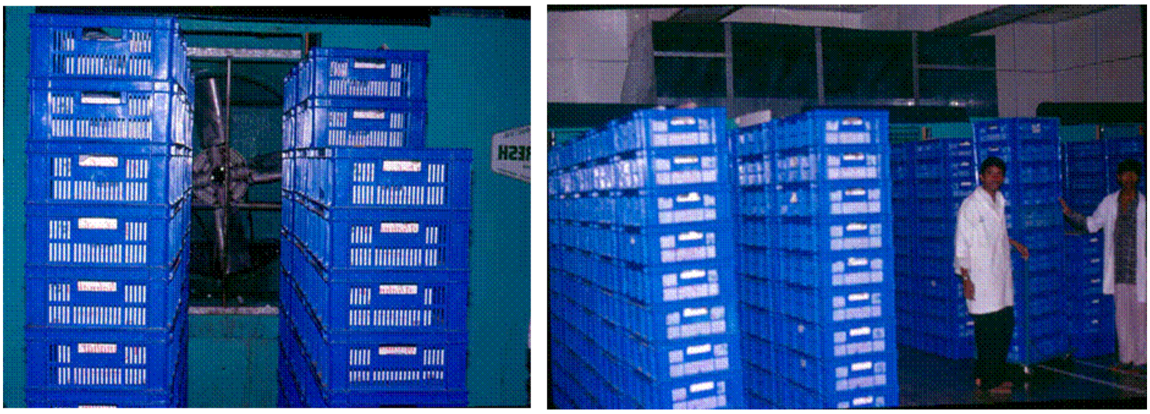

FIG. 5 FORCED AIR PRE-COOLING OF GRAPES

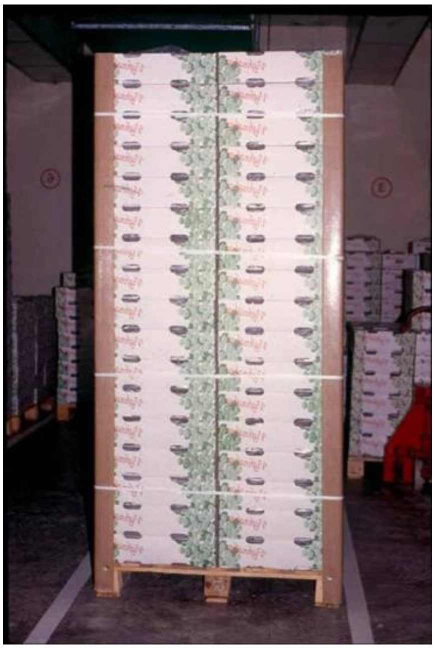

FIG. 6 PALLETIZATION OF GRAPE BOXES

3.4.7 *Temperature Management*

Maintenance of optimum temperature during different stages of handling grapes such as packing, precooling, transportation and storage helps in maintaining the quality of fresh grapes. Care should be taken to maintain the constant temperature continuously. The cool chain has to be maintained throughout, right from harvest till the produce reaches the destination. While removing the grapes from cool stores for marketing, the gradual rise of temperature from 1 °C to 25 °C is essential to prevent condensation of moisture on the berries which enhances rotting.

3.4.8 *Storage Life*

Grapes can be stored for less than a week at ambient temperature even when using grape guard. At optimum low temperature, grapes can be stored for about 2 weeks without grape guard and can be stored for about 8-12 weeks when grape guard is used depending on the variety.

3.5 Better Post Harvest Operations for Prevention of Desiccation

Annex A provides guidelines on good practices for better post harvest operations for prevention of desiccation.

ANNEX A

(*Clause* 3.5)

GUIDELINES ON GOOD PRACTICES FOR BETTER POST HARVEST OPERATIONS FOR PREVENTION OF DESICCATION

Optimum maturity → Avoid immature bunches
↓
Harvesting and handling → Use gloves to avoid loss of bloom
↓
Transport to pack house → Avoid sun exposure/ use refrigerated vans
↓
Pack-house → Maintain low temp. and high humidity
↓
Trimming, grading and weighing → Use gloves to avoid loss of bloom
↓
Packing → Use PE lining
↓
Precooling → Use humidified forced air cooling
↓
Storage → Low temperature and high humidity (90-95 percent)

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Fruits, Vegetables, and Allied Products Sectional Committee, FAD 10

Organization	*Representative(s)*
ICAR-Indian Institute of Horticultural Research, Bengaluru	DR M. R. DINESH (***Chairman***)
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Association of Food Scientists and Technologists India, Mumbai	DR REVATHY BASKARAN DR K. V. HARISH PRASHANTH (*Alternate*)
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Review of Indian Standards Related to Storage, Transport and Ripening of Fresh Fruits and Vegetables, FAD 10 : Panel 2

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Bhabha Atomic Research Centre, Mumbai	Dr Satyendra Gautam
ICAR-Indian Institute of Horticulture Research, Bengaluru	Dr D. V. Sudhakar Rao
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Warehousing Development and Regulatory Authority, New Delhi	Shri Vinay Kumar Chauhan

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Amendments Issued Since Publication

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